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| 09/805,027      | 03/12/2001  | Lloyd G. Burrell     | FIS920000242US1     | 1563             |

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EXAMINER

LEWIS, MONICA

ART UNIT PAPER NUMBER

2822

DATE MAILED: 01/31/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/805,027

Applicant(s)

BURRELL ET AL.

Examiner

Monica Lewis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 11-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

1. This office action is in response to the amendment filed November 14, 2002.

#### ***Response to Arguments***

2. Applicant's arguments with respect to claims 1-10 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claim 1, 4, 5 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Colgan et al. (U.S. Patent No. 5,565,707).

In regards to claim 1, Colgan et al. ("Colgan") discloses the following:

- a) a patterned aluminum layer (30) (See Figure 1);
- b) a patterned copper layer (40) (See Figure 1);
- c) a stud connection (12) in an opening (36) in a layer of material between a location on said patterned copper layer and a location on said patterned aluminum layer (See Figure 1); and
- c) a liner in said opening and extending between said stud connection and said location on said patterned copper layer (See Column 4 Lines 23-27).

In regards to claim 4, Colgan discloses the following:

- a) a stud connection is formed of tungsten (See Column 2 Lines 65 and 66).

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In regards to claims 5 and 8, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (See Column 5 Lines 23-27).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 2 and 6 are rejected under 35 U.S.C. 103(a) as obvious over Colgan et al. (U.S. Patent No. 5,565,707) in view of Barth (U.S. Publication No. 2002/0102809).

In regards to claim 2, Colgan fails to disclose the following:

a) a layer of tantalum nitride, and a layer of PVD tungsten.

However, Barth et al. ("Barth") discloses a liner comprising a layer of tantalum nitride, and a layer of tungsten (See Page 4 Paragraph 49). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner comprising layer of tantalum nitride, and a layer of tungsten as disclosed in Barth because it aids in protecting the device from materials leeching (See Page 4 Paragraph 49).

Additionally, since Colgan and Barth are both from the same field of endeavor, the purpose disclosed by Barth would have been recognized in the pertinent art of Colgan.

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In regards to claim 6, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (See Column 5 Lines 23-27).

7. Claims 3 and 7 are rejected under 35 U.S.C. 103(a) as obvious over Colgan et al. (U.S. Patent No. 5,565,707) in view of Tobben et al. (U.S. Patent No. 6,261,950).

In regards to claim 3, Colgan fails to disclose the following:

a) a layer of titanium, and a layer of titanium nitride or PVD tungsten.

However, Tobben et al. ("Tobben") discloses a liner comprising a layer of titanium, and a layer of titanium nitride (See Column 1 Lines 29-34). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a liner comprising a layer of titanium, and a layer of titanium nitride as disclosed in Tobben because it aids in providing low resistivity (See Column 1 Lines 29-34).

Additionally, since Colgan and Tobben are both from the same field of endeavor, the purpose disclosed by Tobben would have been recognized in the pertinent art of Colgan.

In regards to claim 7, Colgan discloses the following:

a) a patterned aluminum layer includes a layer of at least one of titanium, and titanium nitride (See Column 5 Lines 23-27).

8. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as obvious over Colgan et al. (U.S. Patent No. 5,565,707) in view of Jain (U.S. Patent No. 5,933,758).

In regards to claim 9, Colgan fails to disclose the following:

a) a covering layer.

However, Jain discloses a covering layer (50) (See Column 5 Lines 25-28). It would have been obvious to one having ordinary skill in the art at the time the invention was made to

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modify the semiconductor device of Colgan to include a covering layer as disclosed in Drynan because it aids in increasing component density (See Figure 5).

Additionally, since Colgan and Jain are both from the same field of endeavor, the purpose disclosed by Jain would have been recognized in the pertinent art of Colgan.

In regards to claim 10, Colgan fails to disclose the following:

a) a covering layer includes a layer of silane based high density plasma oxide.

However, Jain discloses a covering layer (50) (See Column 5 Lines 25-28). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Colgan to include a covering layer as disclosed in Drynan because it aids in increasing component density (See Figure 5).

Additionally, since Colgan and Jain are both from the same field of endeavor, the purpose disclosed by Jain would have been recognized in the pertinent art of Colgan.

### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Chung (U.S. Patent No. 5,691,572) discloses an interconnect structure; b) Chiang et al. (U.S. Patent No. 5,739,579) discloses a method for forming interconnects; c) Cronin et al. (U.S. Patent No. 5,808,364) discloses a interconnects using metal spacers; d) Chung (U.S. Patent No. 5,798,299) discloses an interconnect structure; e) Joshi et al. (U.S. Patent No. 5,889,328) discloses a refractory metal capped low resistivity; f) Grill et al. (U.S. Patent No. 5,945,155) discloses a low dielectric constant amorphous fluorinated carbon; g) Joshi et al. (U.S. Patent No. 5,976,975) discloses a refractory metal capped low resistivity metal conductor; h) Chatila et al. (U.S. Patent No. 6,016,012) discloses a thin liner layer providing reduced via resistance; i) Andreas (U.S. Patent No. 6,265,781) discloses a metallization structures; j) Diwald et al. (U.S. Patent No. 6,277,761) discloses a method of fabricating stacked vias; k) Raaijmakers et al. (U.S. Publication No. 2001/0054769) discloses protective layers prior to alternating layer; l) Allman et al. (U.S. Patent No. 6,342,734) discloses an interconnect capacitor; m) Chen et al. (U.S. Patent No. 6,399,486) discloses an improved copper gap fill; and n) Jain et al. (U.S. Patent No. 6,417,092) discloses a low dielectric constant etch stop.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final

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communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML

January 24, 2003



**AMIR ZARABIAN  
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